

Nutritional and Phytochemical Compositions of the Leaves of *Mucuna Poggei*

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Abstract

The chemical nutrient composition and the phytochemical content of the leaves of *Mucuna poggei*, an underutilized leafy vegetable were analyzed using standard methods. The result of the proximate compositions analysis showed that the leaves contained moisture (8.25%), crude fibre (30.55%), crude fat (9.45%), ash (7.78%), crude protein (32.38%) and carbohydrate (11.55%). Results of the mineral analysis showed that it contains the following essential minerals: Sodium (68.10mg/100g), potassium (43.21mg/100g), calcium

(71.71mg/100g), iron (10.56mg/100g), manganese (0.65mg/100g), copper (0.47mg/100g), magnesium (56.05mg/100g), zinc (0.25mg/100g), phosphorus (5.72mg/100g), lead (0.01mg/100g), cobalt (nil) and cadmium (nil). The high protein and fibre contents as well as other proximate components are a desirable attribute. The concentration of iron shows that *Mucuna poggei* leaves could help in boosting of blood level in anaemic conditions. The phytochemical screening of the leaves revealed the presence of alkaloids, tannins, carbohydrates, terpenoids, balsams and triterpenoids. These results rank the leaves of *Mucuna poggei* among the best in terms of essential nutrients composition when compared with those of other edible leaves in literature.

Keywords: *Mucuna poggei*, Leaf composition, Mineral content, Nutrition.

1. Introduction

It has been observed that there is an increased awareness on the importance of wild or semi-wild plants owing to their high vitamins, minerals, essential fatty acids and fibre contents (Tukan *et al.*, 1998). Although conventional food plants have the capabilities of providing most of the nutrients needed for energy, body building, maintenance and regulation of body processes, the need to explore some seemingly unappealing sources of nutrient have become imperative owing to the serious threat to growth, development and survival posed by increasing population, food insecurity and economic crises in most developing nations like Nigeria (Hassan *et al.*, 2007). Most of these are utilized to provide not only nutrients but also traditional treatment for various ailments.

Mucuna poggei is one of such plants with physical characteristics that are repelling to both human and animals from getting closer. It is of the family: *Fabaceae*, Subfamily: *Faboideae*, Tribe: *Phaseoleae*, Subtribe: *Erythrinae*, Genus: *Mucuna*, Species: *poggei* and Variety: *Mucuna poggei* var. *pesa* (GRIN, 2006). It is widely distributed in the Democratic Republic of Congo, Tanzania, Uganda, Malawi, Mozambique, Zambia and Zimbabwe (Hyde, 2012). It is known as “horse eye bean” and other local names in respect to different tribes and ethnic groups exist. It is called “agbara” by Igbos; “matara” by Hausas; “igbekpe” in Benin, and “werepe” by Yorubas (Adewale and Mozie, 2010). *Mucuna poggei* (Figure 1) is a trifoliate trimming annual climber known as the farmer’s enemy. Flowers are creamy or yellowish. The leaves are silky-pubescent beneath. Fruits are covered by itchy hairs that break loose on slight touching when fully dry in savannah woody and deciduous forest and secondary jungle (Bisby *et al.*, 2007). In fact, a critical description of *Mucuna poggei* presents it as a vigorous, large liane plant with stems attaining 12-30 m in length. Leaflets are rhomboid, ovate or obovate, with laterals very asymmetrical, 10-19 cm long, 6-15.5 cm wide, apiculate or rounded at the apex, rounded to subcordate at the base, sparsely ad pressed pubescent above, densely adpressed silvery grey beneath or in some variants woolly or glabrescent but for hairs on the nerves; stipules triangular. Inflorescences are pendulous, usually with numerous flowers; grayish or ferruginous tomentose. There are several flowers per node which are standard greenish-white or yellowish, ovate to elliptic; wings and keel greenish-cream, sometimes with tinge of purple along the edges. Pods are 2-5-seeded, 14-20 cm long, 3.5-4 cm wide, 1.8 cm thick, densely covered with deciduous orange-brown or orange-red bristly very irritant hairs.

Seeds of *Mucuna* are purple or pale brown with dense dark brown mottling that are irregularly elliptic-oblong and much compressed (Ibrahim, 1989)

Mucuna plants have been reported to possess useful phytochemicals of high medicinal value of human and veterinary importance and also serve as raw material in Ayurvedic and folk medicines (Sridhar and Bhat, 2007). The seeds of *Mucuna poggei* have very rich amino acid profile when compared with other species, containing the highest percentage of lysine among others (Tuleun *et al.*, 2008). However, information on the nutritional content of the leaves of *Mucuna poggei* is still very scanty.

In order to boost their blood levels, most rural dwellers in some parts of Nigeria, especially the Igbo speaking people have resorted to oral administration of the crude aqueous extract of *Mucuna poggei* as the cheapest source of multivitamins. This study therefore focuses on the phytochemical screening, mineral analysis and the proximate analysis of *Mucuna poggei* leaves with a view to assessing its nutritional potentials in relation to its ethnomedicinal uses.

2. Materials and Methods

Sample collection

Fresh plants of *Mucuna poggei* were collected from Ukehe in Igbo Etiti L.G.A of Enugu State Nigeria. Identification of the species and variety were done at the Botany Department of Ebonyi State University Abakaliki, Nigeria. The leaves were separated from the stalks, washed and room dried for 3 weeks, blended into fine powder using blending machine and stored in a covered plastic container for further use. All reagents were of analytical grade unless otherwise stated. Distilled/deionized water was used in the preparation of solutions.

Sample analysis

The proximate analyses were carried out in triplicates and the results obtained were the average values. The estimation of the various nutrient parameters in *Mucuna poggei* leave was carried out using the methods of AOAC (1990).

Mineral analysis were carried out after acid digestion of 2g of the grounded leaf sample with 10ml of a mixture of nitric acid and perchloric acid (2:1 v/v) until a clear solution was obtained. The digest was allowed to cool and then transferred into a 100ml standard flask and made up to mark with de-ionized water. The mineral elements were analyzed with atomic absorption spectrophotometer (GBC Avanta Ver 2.02 Model, Australia) equipped with air-acetylene flame. The phosphorus content was determined colorimetrically using spectro 21D (PEC medicals, USA) spectrophotometer while sodium and potassium were determined using a flame photometer (Gallenkamp flame analyser, UK).

Phytochemical screening procedures carried out were by the method of Odebiyi and Sowofora after 10g of *Mucuna poggei* leaves were soaked in 100ml ethanol for 24hrs and then filtered.

3. Results and Discussion

Table 1 presents the result for the proximate analysis of *Mucuna poggei* leaves. It shows that

it contains 11.55% of carbohydrate, 32.38% crude protein, 7.78% ash, 30.55% crude fibre, 9.45% fat and 8.25% moisture. Protein had the highest percentage value while ash had the least.

The crude fibre content of *M. poggei* leaves (30.55%) was higher than 3.65% reported for seeds of 12 *Mucuna* accessions in Nigeria (Ezegu *et al.*, 2003); 8.61% reported for *Amaranthus hybridus* (Akubugwo *et al.*, 2007) and 22.36% reported by Hassan and Ngaski (2007). This quality of the *Mucuna poggei* leaves is highly desirable because adequate intake of dietary fibre can lower serum cholesterol level, risk of coronary heart disease, hypertension, constipation, diabetes, colon and breast cancer (Rao and Newmark, 1998; Ishida *et al.*, 2000).

The crude protein content (32.38%) was quite higher than the reported values of some Nigerian leafy vegetables (Hassan and Umar, 2006; Hassan and Ngaski, 2007; Nnamani *et al.*, 2009; Onwordi *et al.*, 2009; Puangpronpitag *et al.*, 2010). This indicates that *Mucuna poggei* leaf is a good source of protein of dietary protein supplement to meet the recommended daily requirement for humans (FND, 2002). The importance of protein to animals and human health cannot be over emphasized, therefore *Mucuna poggei* leaves could be used both as feed and food protein supplements.

The leaves contained 9.45% crude lipid, which is lower than the values reported for water spinach leaves and *Senna obtusifolia*, but higher when than the values seen in spinach leaves, chaya leaves and *Amaranthus hybridus* leaves (Nwaogu *et al.*, 2000). Crude lipids are the principal sources of energy but should be consumed with caution so as to avoid obesity and other related diseases. A diet providing 1-2% of its caloric energy as fat is sufficient in human beings as excessive consumption has been implicated in certain cardiovascular disorders such as atherosclerosis, cancer and aging (Antia *et al.*, 2006).

The ash content of 7.73% indicates that the leaves are rich in mineral elements. This value is higher than that reported for sweet potato leaves and *Tribulus terrestris* leaves, but lower than some leafy vegetables commonly consumed in Nigeria such as *Talinum triangulare*, *Occimum gratissimum* and *Hibiscus esculentum* (Asibey-Berko and Tanyie, 1999; Nwaogu *et al.*, 2000; Akindahunsi and Salawu, 2005).

The moisture content was lower than those reported for *Acalypha hispida*, *Acalypha racemosa* and *Acalypha maginata* (Iniaghe *et al.*, 2009). The low moisture content of the leaves would hinder the growth of micro organisms and shelf life could be higher (Adeyeye and Ayejuyo, 1994). The carbohydrate content of the leaves (11.55%) is considerably low compared to some other leafy vegetables like *Tribulus terrestris* "Tsaida" and *Corchorus tridens* (Asibey-Berko and Tayie, 1999).

The result of mineral analysis (table 2) showed that calcium had the highest concentration (71.71mg/100g). Considering the importance of Calcium for the growth and maintenance of bones, teeth and muscles, this value could be said to be low since it can only contribute about 5.9% to the Recommended Daily Allowance (RDA) values of calcium for an adult man with 300kcal/day whose recommended energy intake is 1200mg (NRC, 1989; Dosunmu, 1997;

Turan *et al.*, 2003). This implies that *Mucuna poggei* can slightly contribute to the amount of dietary calcium. The phosphorus content was also low (5.72mg/100g). Calcium and phosphorus are the minerals present in the largest quantity in the structure of the body and bones. The concept of Ca/P ratio as introduced by Shills and Young (1988) takes into cognizance that diets rich in animal proteins and phosphorus, promotes the loss of calcium in urine, resulting in a decrease of calcium levels in bones. Niemen *et al.*, (1992) considered a food source good if the Ca/P is above 1 and poor if the ratio is less than 0.5. *Mucuna poggei* leaves with 12.54 Ca/P are therefore a good source of minerals needed in bone formation.

The potassium content of *Mucuna poggei* (43.21 mg/100g) is higher than the values found in *Indigofera astragelina* leave, but lower than in *Cassia siamea* leaves (Gafar *et al.*, 2011; Ngaski, 2006). However, this value is very and can only contribute very little to the body requirement of the dietary potassium. The leaves of *Mucuna poggei* can only contribute about 2.1% of the Recommended Daily Allowance (RDA) of potassium which is 2000mg for adults (NRC, 1989). The Sodium content of *Mucuna poggei* leaves 68.10mg/100g was higher than that of *Senna obtusifoliat* leaves (Lintas, 1992). *Mucuna poggei* leaves can contribute about 13.6% to RDA since the RDA value for sodium for adult is 500mg (NRC, 1989). The importance of Na/K ratio in the body in controlling high blood pressure cannot be over emphasized (Yusuf *et al.*, 2007). *Mucuna poggei* leaves with 1.58 Na/K is good and adequate; therefore, use of the leaves as vegetable in diets could be useful in lowering blood pressure. Magnesium is an important mineral element in connection with its role in circulatory diseases such as ischemic heart disease and calcium metabolism in bone (Ishida *et al.*, 2000; Hassan and Umar, 2006). The magnesium content of the leaves is 56.05mg/100g which is higher than the value reported for *Amaranthus hybridus* leaves (Nwaogu *et al.*, 2000) but lower than that of *Cassia siamea* leaves (Ngaski, 2006). *Mucuna poggei* leaves can contribute about 16.01% to RDA since the RDA for magnesium in adult is 350mg (NRC, 1989). This means the leaf can serve as a source of magnesium.

Copper is important in diet since it is a very powerful pro-oxidant and catalyzes the oxidation of unsaturated fats and oil as well as ascorbic acid (John, 1999). The copper content of *Mucuna poggei* was 0.47mg/100g which is far much higher than values in *Indigofera astragelina* leave (Gafar *et al.*, 2011), but lower than the value in *T. terrestris* leaves (Hassan *et al.*, 2005). *Mucuna poggei* leaves could also serve as a fair source of copper in both animal and human diets since the RDA value for copper is 1.5-3mg for a male adult and 15.67-31.33 % are contributed to the RDA by *Mucuna poggei*(NRC, 1989).

The iron content of *Mucuna poggei* was 10.58mg/100g which is high when compared with the values found in *T. terrestris* and in some cultivated vegetables such as spinach , lettuce and cabbage, but lower than 70.00mg/100g in *cassia siamea* (Turan *et al.*, 2003; Ngaski, 2006). The importance of iron as a trace element in the body can be seen in its role in hemoglobin formation, normal functioning of the central nervous system and oxidation of carbohydrates, protein and fats (Adeyeye and Okokiti, 1999). This value for iron shows that *Mucuna poggei* leaves could help in boosting the blood level in anaemic conditions (NRC, 1989). Rural dwellers who use the leaves to treat such conditions have claimed huge successes and this percentage iron content of *Mucuna poggei* tends to support their claim.

The zinc content of *Mucuna poggei* is 0.25mg/100g which is greater than that found in *I. astragalina* leaves than that found in *Cassia siamea* leaves (Gafar *et al.*, 2011; Ngaski, 2006). As an essential element in the nutrition of man zinc functions as an integral part of numerous enzymes or as a stabilizer of the molecular structure of sub-cellular constituents and membrane and as well participates in the synthesis and degradation of carbohydrates, lipids, protein and nucleic acids and has shown to play an essential role in polynucleotide transcription and translation and thus in the process of genetic expression (WHO, 1996). *Mucuna poggei* leaves can contribute about 1.70-1.67% of the RDA value of zinc which for male adult is 12-15mg (NRC, 1989). This implies that the leaves are a poor source of zinc.

Manganese is another micro element essential for human nutrition, acting as inactivator for many enzymes (MacDonald *et al.*, 1995). The manganese content in *Mucuna poggei* iwas about 0.65mg/100g which is slightly higher than the values found in *I. astragalina* leaves, but lower than 0.98-38.0mg/100g reported in some locally green leafy vegetables and 11.6mg/100g in Balassam apple (*Momordica balsamina* L.) leaves (Gafar *et al.*, 2011; Hassan and Umar, 2006). The RDA value for manganese is 2-5mg/100g for a male adult and *Mucuna poggei* leaves can contribute about 32.5-13.0% of manganese to the RDA and could be said to be a fairly good source of manganese (NRC, 1989).

Cobalt and Cadmium were absent, but the concentration of lead (0.01mg/100g) in *Mucuna poggei* cannot lead to any health hazard in consumers since it is lower than the maximum permissible limit of 3mg/100g lead for vegetables and thus falls within safe limits for consumption(FAO/WHO, 2001).

The results of phytochemical screening (table 3) indicated the presence of balsams, tannins, triterpenoids, saponins, alkaloids, terpenoids and carbohydrates. The presence of these secondary metabolites has contributed to its medicinal value as well as physiological activity (Safowara, 1996). Various studies have shown that saponins although non toxic can generate adverse physiological responses in animals that consume them. They exhibit cytotoxic effects and growth inhibitions against a variety of cells, making them have anti-inflammatory and anticancer properties. They also show tumour inhibiting activities on animals (Akindahunsi and Salawu, 2005). Steroidal compounds are of importance in pharmacy because of their relationship with such compounds as sex hormones (Okwu, 2001). The presence of some the antinutrients found in the *Mucuna poggei* leaves can be reduced by various processing techniques (Siegler, 1998).

4. Conclusion

From the study, one can deduce that *Mucuna poggei* leaves may serve as constituents of human diet supplying the body with minerals, proteins and crude fibre. The presence of secondary metabolites that are biologically important contributes to its medicinal value and thus can be a potential source of useful drugs.



Figure 1. *Mucuna poggei* plant

Table 1. Chemical composition of *Mucuna poggei* leaves

Component	Value (%)
Moisture	8.25%
Crude fibre	30.55%
Crude fat	9.45%
Ash	7.78%
Crude Protein	32.38%
Carbohydrates	11.55%

Table 2. Mineral composition of *Mucuna poggei* leaves

Minerals	Concentration (mg/100g)
Sodium	68.10
Potassium	43.21
Calcium	71.71
Iron	10.58
Manganese	0.65
Copper	0.47
Magnesium	56.05
Zinc	0.24

Cobalt	Nil
Lead	0.01
Cadmium	Nil
Phosphorus	5.72
Na/K	1.58
Ca/P	12.54

 Table 3. Phytochemical screening of *Mucuna poggei* leaves

Phytochemicals	Result
Balsams	+
Tannins	+
Steroids	-
Triterpenoids	+
Glycosides	-
Antraquinones	-
Saponins	+
Phenols	-
Alkaloids	+
Cardenolides	-
Terpenoids	+
Carbohydrates	+
Flavonoids	-
Cardiac Glycosides	-
Phlobatanannins	-

+ = Positive - = Negative

References

- Adeyeye, E. I. & Okokiti, M. K. (1999). Proximate composition and some nutritional valuable Minerals of two varieties of *Capsicum annum* (Bell and Cherry peppers). *Discovery Innovation*, 11, 75-81.
- Adeyeye, E. I. & Ayejuyo, O. O. (1994). Chemical composition of *Cola accuminata* and *Garcinia kola* seed grown in Nigeria. *International Journal of Food Science and Nutrition*, 45, 223-230.
- Akindahunsi, A. A. & Salawu, S. O. (2005). Phytochemical screening and nutrient-antinutrient composition of selected tropical green leafy vegetables. *African Journal of Biotechnology*, 4, 497- 501.
- Akubugwo, I. E., Obasi, N. A., Chinyere, G. C. & Ugbogu, A. E. (2007). Nutritional and chemical value of *Amaranthus hybridus* leaves from Afikpo, Nigeria. *African Journal of Biotechnology*, 6, 2833- 2839.
- Antia, B. S., Akpan, E. J., Okon, P. A. & Umoren, I. U. (2006). Proximate Composition and Phytochemical Constituents of Leaves of some *Acalypha* species. *Pakistani Journal of*

Nutrition, 5, 166-168

AOAC. (1990). Official Methods of Analysis. 15th Edition, Association of Official Analytical Chemists, Washington DC.

Asibey-Berko E. & Tayei, F. A. K. (1999). Proximate Analysis of some Under Utilized Ghanaian vegetables. *Ghana Journal of Science*, 39, 91-92.

Bisby, F. A., Roskiv, Y. R., Ruggiero, M. A., Ovrell, T. M., Paglinawa, L. E., Brewer, P. W.... Badly, N. & Van, H. (2007). Species 2000 and IT IS catalogue of life. 2007 Annual Checklist Species 2000 Reading, U.K.

Dosunmu, M. I. (1997). Chemical Composition of the Fruit of Tetraptera and the Physico-Chemical Properties of its oil. *Global Journal of Pure and Applied Science*, 3, 61-67.

Ezegu, I. E., Maziya-Dixon, B. & Tarawali, G. (2003). Seed Characteristics and Nutrient and Antinutrient Composition of 12 *Mucuna* accessions from Nigeria. *Tropical and subtropical Agroecocyst*, 1, 129-140.

FAO/WHO. (2001). Codex Alimentarius Commission Food additives and contaminants. Joint FAO/WHO Food Standards Programme, ALINORM 01/12A:1-289.

FND. (2002). Dietary Reference Intake for Energy, Carbohydrate, Fibre, Fat, Fatty Acids, Cholesterol, Protein and Amino Acid (micronutrients). FND, National Academy of Science USA.

Gafar M. K., Itodo, A. U., Atiku, F. A., Hassan, A. M. & Peni, I. J. (2011). Proximate and mineral composition of the leaves of hairy indigo (*Indigofera astragalina*). *Pakistan Journal of Nutrition*, 10(2), 168-175.

Germplasm Resources Information Network (GRIN). (2006). *Mucuna poggei* US Department of Agriculture, Agricultural Research Service. <http://www.ars-grin.gov/npgs/aboutgrin.html>

Hassan, L.G. & Ngaski, M. M. A. (2007). Nutritional Evaluation of Cassia siamen leaves. *Journal of Chem. Soc. Nig.*, 32, 137-143.

Hassan, L. G., Umar, K. J. & Tijjani, A. A. (2007). Preliminary Investigation of the Feed Quality of *Monechma cilition* Seeds. *Chem. Class Journal*, 4, 83.

Hassan, L. G. & Umar, K. J. (2006). Nutritional Value of Balsam Apple (*Moordica balsamina*) Leaves. *Pakistan Journal of Nutrition*, 5, 522-529.

Hassan, L. G., Umar, K. J. Dangogo, S. M. & Ladan, M. J. (2005). Protein and Amino Acids Composition of African Locust Bean (*Parkia biglobosa* L.). *Journal of Tropical and Subtropical Agroecosystems*.

Hyde, M. A., Wursten, B. T. & Ballings, P. (2012). Flora of Zimbabwe: Species information: *Mucuna poggei* var. *pesa*. <http://www.zimbabweflora.co.zw/speciesdata/species.php>

- Ibrahim, K. M. (1989). An illustrated manual of Kenya legumes. Kitale, Kenya, FAO-UNDP, 656.
- Iniaghe O. M., Malomo S. O. & Adebayo J. O. (2009). Proximate Composition and Phytochemical Constituents of Leaves of some *Acalypha* species. *Pakistan Journal of Nutrition*, 8(3), 256-258.
- Ishida, H., Suzuno, H., Sugiyama, N., Innami, S., Todokoro, T. & Maekawa, A. (2000). Nutritional Evaluation of Chemical Component of Leaves and Stems of Sweet Potatoes (*Ipomoea batatas* poir). *Food Chemistry*, 68, 359-367.
- John, M. M. (1999). Principles of Food Chemistry, 3rd edition, 209-223. Lintas, C. (1992). Nutritional Aspects of Fruits and Vegetables Consumption. *Options mediterranees*, 19, 79-87.
- National Research Council (NRC). (1989). Recommended Dietary allowances. National Academy Press, Washington, DC.
- Ngaski, M. M. (2006). Phytochemical Screening and Proximate Analysis of *Cassia siamea* Leaves. M.Sc Dissertation (unpolished) Submitted to Postgraduate School, Usmanu Danfodiyo University Sokoto.
- Nnamani, C. V., Oselebe, H. O. & Agbatutu, A. (2009). Assessment of Nutritional Values of Three Underutilized Indigenous Leafy Vegetable of Ebonyi State, Nigeria. *African Journal Biotechnology*, 8, 2321- 2324.
- Nwaogu, L. A., Ujuwundu, C. O. & Mgbemena, A. I. (2000). Studies on the nutritional and phytochemical Composition of *Amaratus hybridus* leaves. *Bis-Res*, 4, 28-31.
- Okwu, D. E. (2001). Evaluation of the chemical composition of indigenous spices and flavouring Agents. *Global Journal of Pure and Applied Science*, 7, 455-459.
- Onword, C. T., Ogungbade, A. M. & Wusu, A. D. (2009). The Proximate and Mineral Composition of Three Leafy Vegetables Commonly Consumed in Lagos, Nigeria. *African Journal of Pure and Applied Chemistry*, 3, 102-107.
- Rao, C. V. & Newmark, H. L. (1998). Chemo-preventive effect of squalene on colon cancer. *Carcinogenesis*, 19, 287-290.
- Safowara, E. A. (1996). Medicinal Plants and Traditional Medicine in Africa. Spectrum Books Ltd, Ibadan, 55-71.
- Shills, M. E. G and Young, V. R. (1988). Nutrition, Brown publishers, Dubugye USA. 276-282.
- Sridhar, K. R & Bhat, R. (2007). Agrobotanical, Nutritional and Bioactive Potential of Unconventional Legume-Mucuna. *Livestock Res. Rural Dev.* 19, 126-130.
- Tukan, S. K., Takruri, H. R. & Al-Eisaw, D. M. (1998). The use of wild edible plants in the Jordanian diet. *International Journal of Food Science and Nutrition*, 49, 225-235.

Tuleun, C. D., Carew, S. N. & Patrick, J. A. (2008). Fruit characteristics and chemical composition of some varieties of velvet beans (*Mucuna* spp) found in Benue State of Nigeria. *Livestock Research for Rural Development*, 20, 10.

Turan, M., Kordis, S. Zeyin, H. Dursan, A. & Sezen, Y. (2003). Macro and micro minerals content in Some Wild Edible Leaves consumed in Eastern Anatolia. *Tailors and Francis*, 129-130.

Yusuf, A. A., Mofio, B. M. & Ahmed, A. B. (2007). Proximate and Mineral Composition of *Tamarindus indica* linn1753 seeds. *Science World Journal*, 2, 1-4.

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